

## ABSTRACT OF THE DISCLOSURE

Methods and systems for measuring mechanical property of a vascular wall and a method and system for determining health of a vascular structure are provided wherein local deformation of a vessel wall resulting from physiologic pressures with altered transmural forces is measured. A non-invasive free-hand ultrasound scanning procedure was performed to apply external force, comparable to the force generated in measuring a subject's blood pressure, to achieve higher strains by equalizing the internal arterial baseline pressure. When the applied pressure matched the internal baseline diastolic pressure, strain and strain rate increased by a factor of 10 over a cardiac cycle. Radial arterial strain was assessed in the vessel wall over the entire deformation procedure using a phase-sensitive, two-dimensional speckle-tracking algorithm. An elastic modulus reconstruction procedure was developed to estimate the non-linear elastic properties of the vascular wall.